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Emergency Material Prediction in South China Based on Case Analysis Method

Zhaolong Yang#, Yuanda Zhang#, Jianhao Qin*, Zhihui Pan

Institute of Disaster Prevention, Sanhe, Hebei, China
#These authors contributed equally to this work and should be considered co-first authors
**Corresponding Author*

Abstract: ***After the occurrence of flood disasters, timely and rapid emergency response is one of the important tasks to improve the efficiency of emergency rescue and reduce disaster losses, and the prediction of material demand, which is the premise and basis of emergency response in disaster areas after disasters, is one of the key problems that need to be solved urgently. Considering the characteristics of poor information in the post-disaster disaster area, a post-disaster material demand forecasting technology based on fuzzy case reasoning was introduced. Firstly, on the basis of the analysis and summary of the existing case database, the key feature attributes of flood disasters that affect the demand for materials after the disaster are extracted, and the fuzzy set of flood disaster characteristics is established by introducing the concept of fuzzy sets, and then the membership degree of the specific feature attribute values of the new and old cases to the fuzzy set is calculated, in order to measure the similarity between the new and old cases, and the corrected measure closeness based on the weight of the feature attributes of the new and old cases is calculated, and the one with the largest closeness represents the best match between the new and old cases. Finally, an actual case is used to show the specific application process of the technology, and the existing reference cases that are closest to the new case are obtained, which can provide reference for post-disaster emergency rescue. The results show that the proposed method can provide a scientific prediction of the demand for emergency supplies and provide a basis for decision-making for the relevant emergency management departments in an actual flood disaster case in South China.***

Keywords: Fuzzy case-based reasoning method; Flood disasters; Emergency supplies; Demand forecasting.

1. INTRODUCTION

As time marches on and society develops, the field of human activities is expanding while the impact on the natural environment is becoming more and more serious. The occurrence of natural disasters not only affects the harmony and development of the region, but also is closely related to the stability of the country and social security, and has become a serious impediment to economic development and social prosperity and stability. China is one of the high-risk countries for natural disasters in the world, with more than 70% of the country's cities and more than 50% of its population affected by floods, earthquakes, typhoons and other disasters [1]. In the past 10 years, natural disaster events in China have become more complex and severe compared to previous natural disasters. Natural disasters have caused more serious losses, more far-reaching impacts and wider reach, seriously jeopardizing the lives and property of the general public. Among them, the losses caused by large-scale floods in some provinces of the country in 2022 are shown in Table 1 [2]. In recent years, the global extreme weather events show more frequent reoccurrence of the situation, breaking the historical record, subvert the traditional cognitive flood and drought disaster defense events occur frequently, the defense situation is more severe, the task is more difficult [3]. In particular, the problem of extreme rainstorms and floods has become more and more obvious.

Due to the intensity of flooding, wide range, sudden and strong, with obvious regional and seasonal characteristics, urban flood prevention and management has been the focus and difficulty of ensuring the safe operation of the city. In addition to directly causing casualties and economic losses, sudden floods are also prone to expand the impact of disasters through various communication chains. In recent years, large-scale floods caused by extreme weather, time and again, has moved the attention of society. The frequent occurrence of urban storm flooding, especially in 2012 Beijing “7-21”, 2018 Chengdu “7-11” 2021 Henan “7-20” and In particular, Beijing “7-21” in 2012, Chengdu “7-11” in 2018, Henan “7-20” in 2021, and Hebei “7-29” in 2023 were typical torrential rainfall and flooding disasters that seriously affected the safe operation of cities. China has always attached great importance to preventing and resolving the risks of major natural disasters, and after the disasters, government departments and various rescue organizations have been summing up their experiences, strengthening the construction of the emergency management system, and continuously improving the emergency management plan. For the post-disaster emergency material demand forecasting, due to the late start of the research, in the emergency material demand forecasting related research is still in an immature stage.

Floods are prone to affect roads, electric power facilities and communication equipment, which makes it impossible to obtain the exact situation of the disaster and clear emergency material demand from the affected areas. This makes it very difficult to carry out post-disaster emergency relief, and also puts forward higher requirements for the distribution and transportation of emergency materials. Therefore, in the face of the current situation of frequent floods, we should formulate a reasonable rescue program, and do a good job of scientific forecasting of emergency material demand, in order to improve the emergency response capacity and reduce the losses caused by disasters.

Based on this, this paper is based on the case study method to put forward the problem of emergency materials prediction and distribution under flood disaster, with flood disaster as the background, research in the flood disaster, how to quickly and accurately predict the demand for emergency materials, so that the limited amount of reserves of emergency materials to be scientifically deployed for the emergency rescue departments to provide a certain reference value of the decision-making program, at the same time, for the flood disaster after the emergency rescue action to provide some help. Provide certain help.

2. OVERVIEW OF THEORIES RELATED TO EMERGENCY SUPPLIES FORECASTING

2.1 Emergency supplies

Emergency material refers to the general name of all kinds of materials needed in the emergency rescue operation and process to protect people's life and safety in the case of public security emergencies, including some specialized emergency materials and daily-use materials [18].

In order to protect people's lives and safety during an emergency public security incident, emergency supplies are a general term for all kinds of materials needed in the emergency rescue operation and process, including some specialized emergency supplies and daily-use materials [18]. Emergency supplies reserve situation plays a key role in the efficiency of the emergency team to implement rescue, after the disaster, the relevant departments of emergency management according to the disaster situation to carry out preliminary research and judgment, conduct a rapid assessment, co-ordinate the emergency supplies of various departments, and give play to the effectiveness of the emergency supplies.

According to the Classification and Product Catalog of Emergency Protection Materials compiled and issued by the National Development and Reform Commission in 2015, emergency protection materials are divided into three major categories: on-site management and protection materials, referring to materials required for on-site safety monitoring, emergency communication and command, etc.; life rescue and life saving materials, referring to materials related to life search and rescue, dietary and medical protection, etc.; and engineering rescue and professional disposal materials, referring to engineering rescue and repair, Pollution treatment and other required professional class materials.

2.2 Prediction Methods of Emergency Materials

Domestic and foreign scholars' research, the existing emergency supplies demand forecasting research can be broadly divided into the use of mathematical statistics and reasoning techniques for forecasting and the use of historical data and intelligent optimization algorithms for prediction of the two major categories, there are two types of fusion of the research, the background of the research involves a wide range of aspects.

In the related method of using mathematical statistics and inference technology for emergency material demand prediction, i.e., prediction based on mathematical statistics and inference technology, Fu Zhiyan establishes case-based inference based on key factors, and in order to search for the best case, the original data is normalized, and then searched through the Euclidean algorithm so as to construct the material prediction model [4], and Zhao Xiaolime believes that, facing the seismic disaster with incomplete information. Designing a reasonable example library and search conditions can help decision makers to quickly carry out emergency material prediction during the main earthquake period [5]. Liu Deyuan invokes interval number and proposes special influence factors for coefficient adjustment to search for the best in order to solve the problem of emergency material demand [6]; Wang Lanying et al. introduce intuitionistic fuzzy sets to improve the accuracy of prediction [7]. Chao Ying et al. based on fuzzy rough set for dynamic prediction of emergency supplies [8].

Among the related methods of using historical data and intelligent optimization algorithms for emergency supplies demand forecasting, i.e., forecasting based on historical data and intelligent optimization algorithms, Liu, Zheng Zhang, and Jieming Wu analyzed the influencing factors affecting urban flooding, solved the sample over-adaptation which affects the accuracy through K-means clustering, and then used BP neural networks to accurately predict the disaster situation [9]; Jinfen Guo et al. et al. and Qian Fenglin et al. used BP neural networks to predict the number of deaths in earthquakes, which greatly improved their accuracy [10-11] and so on.

There are many methods for demand forecasting, which can basically be categorized into 2 major groups: qualitative and quantitative. Representatives of the former, such as expert forecasting method, which is currently the most used method in China in the post-earthquake material demand forecasting, it is based on the expert's empirical judgment; while representatives of the latter include time series forecasting method, forecasting model method, etc., and the intelligent forecasting method of some intelligent decision support system has been the attention of the scholars and the application of the scholars. The expert prediction method has high requirements on the experience and judgment of experts, and can not easily realize the knowledge transfer; quantitative methods are more dependent on the data, and for the post-earthquake information channel interruption, statistical difficulties, the decision maker can only be based on the oligarchic information to make a quick decision, in this context, based on the case-based reasoning method to find a place to use. Using the little case characteristic information in the case database, analyzing the characteristics of the newborn case with its similarity, using the material demand information of the existing case, supplemented by expert judgment or key factor model, and finally obtaining the emergency material demand prediction of the newborn case, which is obviously a combination of qualitative and quantitative prediction method. Here this study chooses fuzzy case inference method.

2.2.1 Fuzzy Case Reasoning Method

Fuzzy case inference method is to use the case database in the case of not much information about the characteristics of the case, the characteristics of the predicted case and its similarity analysis, the use of existing cases of demand information for matching and prediction of the key characteristics, and finally get the predicted case of the relevant information, so the fuzzy case inference method is also a combination of quantitative and qualitative prediction methods

(1) Fuzzy set

Fuzzy technology has penetrated into almost all scientific fields [13]. By the scholar Kaufmann first proposed the concept of fuzzy variables [14], later cited and developed by Zadeh [15]; first proposed the concept of fuzzy sets and possibility theory [16], and gradually established the axiomatic system of fuzzy sets.

Let U be an argument domain. is a subset of U. For any element X U, the function specifies a value corresponding to it. The value at element X reflects the degree of element X belonging to, then it is called a fuzzy subset, as the affiliation function. According to the summary of previous research, the geometric expression of the affiliation function is generally triangular, trapezoidal, S-shaped and so on. Above the expression of the characteristics of flood disaster, this study adopts the S-shaped affiliation function, as shown in Figure 1.

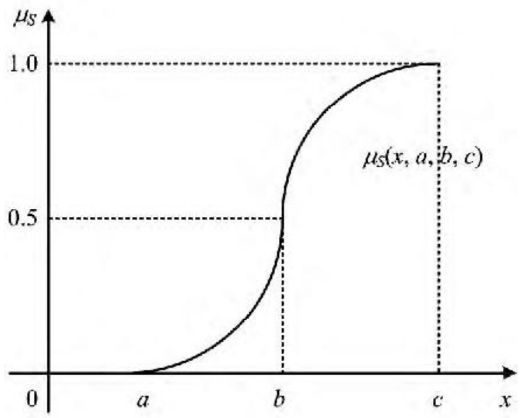

Figure 1: S-shaped affiliation function

(2) Affiliation degree

The affiliation function is said to be a standard S-type affiliation function if the form of the affiliation function satisfies the requirements of the S-shape. For the S-shaped affiliation function, where the value of b is calculated according to equation (1). According to the initial characterization of the newly occurred floods, it is obtained after all the newborn floods characteristic attributes, still need to be similarity judgment with all the existing cases in the case base.

$$b=\frac{1}{2}(a+c) \tag{1}$$

(3) Degree of closeness

Let the fuzzy set , then the mapping N: is called the closeness and satisfies . Fuzzy set of the measure of closeness can be calculated using its affiliation function, the formula is (2) The formula can be modified according to the actual weight of the formula, the more N tends to 1, that is, the more similar the 2 fuzzy sets, and the more it tends to 0, the more the difference is.

$$N\left(\overline{A},\ \overline{B}\right)=\frac{\sum_{i=1}^{m}\left(u_{A}(x_i)\wedge u_{B}(x_i)\right)}{\sum_{i=1}^{m}\left(u_{A}(x_i)\vee u_{B}(x_i)\right)} \tag{2}$$

2.2.2 Coefficient of variation method

Coefficient of variation method (Coefficient of variation method) is a method of objective weighting by directly utilizing the information contained in each indicator and obtaining the weights of the indicators through calculation. The basic principle of this method is that in the evaluation index system, the greater the difference in the value of the indicators, that is, the more difficult to achieve the indicators, so that the indicators are more reflective of the gap in the evaluated unit.

(1) Data Standardization

For different indicators, in order to eliminate the gaps in their scale as well as units, formula (3) is used to standardize the data.

$$Z_{ij}=\frac{X_{ij}}{\sum_{i=1}^{n}X_{ij}*X_{ij}} \tag{3}$$

(2) Calculate the mean value of the indicator

As shown in equation (4) below.

$$\sigma^2=\frac{\sum(x-\overline{x})^2}{n} \tag{4}$$

(3) Calculate the coefficient of variation of the indicator

As shown in equations (5)-(8) below.

$$|x_1-\overline{x}|+|x_2-\overline{x}|+\ldots|x_n-\overline{x}|=\sum|x-\overline{x}| \tag{5}$$

$$A.D. = \frac{\sum \left| x - \bar{x} \right|}{n} \tag{6}$$

$$V_{A.D} = \frac{A \bullet D.}{x} \tag{7}$$

$$V_{\sigma} = \frac{\sigma}{\mathrm{x}} \tag{8}$$

(4) Calculation of weights of indicators

The calculated coefficient of variation V is normalized to the calculated weights W. This is shown in equation (9) below [17].

$$\omega_{ij} = \frac{V_i}{\sum_{j=z}^{n} V_i} \tag{9}$$

3. STUDY AREA AND DATA SOURCES

3.1 Overview of the study area

South China refers to Guangdong Province, Guangxi Zhuang Autonomous Region, Hong Kong Special Administrative Region, Macao Special Administrative Region, Hainan Province and adjacent islands. Although in many cases, Fujian Province and Taiwan Province are nominally included in the East China region, Fujian and Taiwan Provinces mostly belong to the South China plate in terms of culture, customs, bloodline and movement of people, especially the local culture of Fujian Province's south-central Fujian Province, which shares a common historical origin with that of Guangdong Province's Xijiang River Basin (Guangzhou, Zhaoqing), Dongjiang River Basin (Huizhou, Meizhou), and the east-wing coast (Minnan). And when conducting research related to emergency management, especially about preventing and mitigating the risk of natural disasters and conducting emergency material needs assessment, considering that the climate, geomorphology, hydrological conditions and other factors of the relevant regions are very similar, Xu Feng and other scholars have included Guangxi, Guangdong, Fujian and Hainan provinces together into the South China region when conducting the study of climate change in the South China region [12]. Therefore, this study adopts the broad South China region (Guangdong, Guangxi, Fujian, Hainan, Hong Kong, Macao, and many archipelagos) to conduct the study of emergency supplies needs assessment.

South China is mainly located on the southern subtropics, belonging to the tropical and subtropical monsoon climate, with high temperature and rainfall all year round and abundant precipitation. There are subtropical westerly winds, equatorial westerly winds and tropical easterly winds, and there are many types of climate in the region due to the influence of topography and geomorphology. Annual precipitation in most parts of South China is less than that inland along the coast and on the islands, but it is more abundant in places with frequent typhoon activities because of the complexity of the region's topography, altitude and proximity to the sea. The region's average annual relative humidity is generally larger, the annual sunshine hours in the above, sunshine and radiation are very rich. At the same time, the region is also China's most frequent typhoon activity in the western Pacific Ocean, due to the low latitude, adequate sources of water vapor coupled with suitable flow field conditions, so the region's torrential rains also occur frequently.

Therefore, for the flood-prone South China, after the occurrence of floods, the disaster area is in urgent need of all kinds of living materials, the demand forecast for emergency supplies is the first step of emergency relief after the occurrence of the disaster needs to be accomplished by the task of action, but also the most critical step.

3.2 Data sources

The case data used in this case reasoning come from the China Water and Drought Disaster Defense Bulletin, China Meteorological Disaster Atlas, the Statistical Yearbook of each province, and local news reports from 2009 to 2022. Because the amount and types of emergency supplies required are affected by many characteristics, such as regional restrictions and the degree of disaster, the nine main indicators of rainfall level, rainfall duration, affected population (10,000), dead and missing population (people), emergency relocation of population (10,000), crop-affected area (1,000 hectares), crop-harvested area (1,000 hectares), the number of collapsed houses (10,000), and the direct economic loss (100 million yuan) are included. The number of cases of the nine main indicators, including the number of collapsed houses (10,000) and direct economic losses (100 million yuan), was finally 56 cases.

4. EMERGENCY MATERIAL FORECAST OF FLOOD DISASTER IN SOUTH CHINA BASED ON FUZZY CASE INFERENCE METHOD

4.1 Prediction of emergency supplies demand

This study adopts the method of indirect prediction to predict the quantity of flood emergency supplies, firstly, according to a variety of characteristic indicators of flood disasters to find a similar case, and then through the relationship between the population and the material model, which in turn leads to the quantity of demand for emergency supplies.

Through the data, the database of flooding disasters occurred in South China from 2009 to 2022 is established, and the data of the affected areas' disaster situation and rainfall situation are collected and organized, and the data of the last three years are adopted according to the data situation. Table 1 below shows some of the floods that occurred in the three years from 2020 to 2022.

Table 1: Information on floods in South China, 2020-2022

Number	Year	Rainfall level	Rainfall duration	Affected population	Deaths and missing population	Emergency relocation population	Crop-affected area	Crop-harvested area	Number of houses that collapsed	Direct economic loss
12	2020	2	4	3.0	0	0.9	7	0	0.0	1.2
26	2020	4	2	224.2	10	24.8	130	16	0.3	112.0
40	2020	4	4	88.9	9	7.7	59	8	0.2	49.8
54	2020	4	4	13.8	0	2.5	16	2	0.0	21.1
...	...	...	...	...	...	...	...	...	...	...
28	2022	4	2	483.4	8	27.2	211	21	0.5	130.7
42	2022	3	4	248.0	5	28.4	113	26	0.5	161.1
56	2022	4	3	108.0	0	21.8	60	7	0.5	168.7

4.1.1 Case feature attribute expression

According to the database cases, there are a total of 56 cases, each case has 9 feature attributes, the ith case is expressed by denote, the jth attribute of the ith case is denoted by denote, then the data matrix can be constructed as shown in the following equation 10 structure.

$$F = \begin{vmatrix} f_{11} & f_{12} & \dots & f_{19} \\ f_{21} & \dots & \dots & f_{29} \\ \vdots & \dots & \dots & \vdots \\ f_{561} & \dots & \dots & f_{569} \end{vmatrix} \tag{10}$$

4.1.2 Calculation of attribute affiliation of features

Based on the experience and existing studies, the nine indicators of rainfall level, rainfall duration, affected population (10,000 people), dead and missing population (people), emergency relocation population (10,000 people), crop-affected area (1,000 hectares), crop-harvested area (1,000 hectares), collapsed houses (10,000 houses), and direct economic loss (100 million yuan) are selected to indicate the disaster situation of the flooding disaster.

4.1.3 Case similarity analysis

Firstly, according to the method of superiority and inferiority coefficient, the intrinsic mathematical characteristics between the characteristic attributes are analyzed, and then the degree of influence of each characteristic attribute of the flood disaster on the demand for emergency supplies, i.e., weight W, is obtained after mathematical processing, and there are . The feature attribute affiliation vectors of the new cases, i.e. , are compared, one by one, with the 1st to the 56th row vectors in the matrix F, according to the measure closeness formula for calculating their similarity, and the 56 measure closenesses obtained by the calculation are ranked.

The feature attribute information of each case is extracted from the cases. According to the above affiliation function and the feature attribute information in the cases, the affiliation degree of all the old and new cases to the fuzzy set can be calculated, and the parameters a,b,c,d are determined empirically, as shown in Table 2.

Table 2: Parameter settings in the affiliation function for characteristic attributes of flooding disasters

Prameter	Rainfall level	Rainfall duration	Affected population	Deaths and missing population	Emergency relocation population	Crop-affected area	Crop-harvested area	Number of houses that collapsed	Direct economic loss
a	2	2	0.2	0	0	0	0	0	0
b	3	3	490.7	88.5	78.9	269.655	23.5	3.45	84.35
c	4	4	981.2	177	157.8	539.31	47	6.9	168.7

Using the coefficient of variation method, the weights of each feature attribute are calculated according to equations (3)-(9) as shown in Table 3.

Table 3: Weights of feature attributes

Term	Average Value	Standard Deviation	CV coefficient	Weight
Rainfall level	3.089	0.837	0.271	0.02639
Rainfall duration	3.089	0.837	0.271	0.02639
Affected population	166.943	193.725	1.16	0.113
Deaths and missing population	23.268	33.967	1.46	0.14215
Emergency relocation population	17.207	29.103	1.691	0.16469
Crop-affected area	99.97	122.233	1.223	0.11906
Crop-harvested area	10.179	12.879	1.265	0.12321
Number of houses that collapsed	0.812	1.45	1.785	0.1738
Direct economic loss	39.029	44.615	1.143	0.11131

According to the existing database cases, set the indicators of the cases to be predicted as shown in Table 4.

Table 4: Attributes of the prediction case

Number	Year	Rainfall level	Rainfall duration	Affected population	Deaths and missing population	Emergency relocation population	Crop-affected area	Crop-harvested area	Number of houses that collapsed	Direct economic loss
G	Time	3	3	120	5	35	50	10	0.5	150

The closeness of each case in the database to the predicted case is calculated according to equations (1)-(2), and the results are shown in Table 5 below.

Table 5: The results of the closeness between the cases in the database and the predicted cases

No.	Proximity	No.	Proximity	No.	Proximity	No.	Proximity
1	0.022	15	0.484	29	0.253	43	0.15
2	0.466	16	0.37	30	0.536	44	0.303
3	0.015	17	0.542	31	0.212	45	0.047
4	0.01	18	0.547	32	0.317	46	0.278
5	0.401	19	0.227	33	0.566	47	0.208
6	0.009	20	0.403	34	0.603	48	0.323
7	0.022	21	0.457	35	0.274	49	0.603
8	0.311	22	0.311	36	0.301	50	0.302

9	0.047	23	0.481	37	0.236	51	0.118
10	0.001	24	0.238	38	0.311	52	0.04
11	0.009	25	0.408	39	0.338	53	0.509
12	0.015	26	0.54	40	0.364	54	0.091
13	0.005	27	0.123	41	0.044	55	0.138
14	0.001	28	0.499	42	0.446	56	0.349

Based on the comparison of case closeness, we find that case number 34 has the greatest closeness to the predicted case, 0.603, and checking the data sources, we find that the emergency supplies used in this case are as shown in the following Table 6.

Table 6: Use of emergency supplies for flooding case number 34

Emergency supplie	Drinking water (10L)	Food (10T)	Antibiotics (100,000)	Quilts (100,000)	Tents (100,000)
Utilization	21476	17.56	17.63	5.365	2.574

4.1.4 Prediction of emergency supplies

Based on the ratio of the affected population between the predicted case and the matched case, the emergency material requirements for the predicted case are calculated. It is shown in the table below in Table 7 .

Table 7: Use of emergency materials for flooding in the predicted cases

Emergency supplie	Drinking water (10L)	Food(10T)	Antibiotics (100,000)	Quilts (100,000)	Tents (100,000)
Utilization	14828	12	12	4	2

4.2 Analysis of results

In this study, firstly, on the basis of analyzing and summarizing the existing case base, a number of key feature attributes of flood disaster affecting the demand for post-disaster materials are extracted, and a fuzzy set of flood disaster features is established by introducing the concept of fuzzy set. Secondly, the affiliation degree of the specific feature attribute values of the old and new cases to the fuzzy set is calculated, and in order to measure the degree of similarity between the old and new cases, the modified measure of closeness based on the weights of the feature attributes of the old and new cases is calculated, and the one with the largest degree of closeness represents the best match between the old and new cases. Finally, an actual case is used to demonstrate the specific application process of the technique, to obtain the existing reference case that is closest to the new case, and to provide a reference for the prediction and distribution of post-disaster emergency supplies.

5. CONCLUSION AND OUTLOOK

5.1 Conclusion

This paper predicts the emergency material demand after flooding based on the fuzzy case reasoning technique. The establishment of a flood disaster database utilizes a combination of fuzzy set and case-based analysis techniques to defuzzify nine characteristic attributes of flood disasters. Subsequently, fuzzy set affiliation is calculated between the cases to be predicted and the existing cases in the case database. On the basis of obtaining the weights of the characteristic attributes, the similarity between the old and new cases based on the measure closeness is calculated. The closest scenario is selected for simulation calculation to derive the material requirements.

The emergency supplies needed for this prediction case are: drinking water 214,760 liters. 175.6 tons of food, 1,763,000 antibiotics, 536,500 quilts, and 257,400 tents.

5.2 Outlook

In this paper, the problem of emergency supplies prediction and distribution are explored to a certain extent, but based on personal research ability and the limited length of the article, there are still many shortcomings, and the future can be further explored in depth in the following areas:

5.2.1 Transportation cost problem

In this paper, the distribution of emergency supplies only considers the unidirectional transportation from multiple distribution centers to the disaster site, and does not consider the round-trip and distribution costs of vehicles. In future research, the problem of multiple round trips for material distribution can be considered when timeliness is satisfied, while considering distribution costs.

Large floods have a large impact on roads, transportation and so on. Therefore, in this paper, in the process of material distribution, the assumption conditions are more and idealized, and all the objective influencing factors are not fully considered. In the future research and discussion, the distribution of materials needs to consider the situation where vehicles can not pass, and can rely on water transportation, air transportation, etc. to realize the distribution of materials.

5.2.2 Forecast indicator problem

Due to the complexity of large-scale flooding, this paper selects the predictive indicators of the affected transfer population, chooses the indicators that the data are easier to obtain and the characteristics are stronger and easier to quantify. In the future, when predicting the affected population, more influencing factors can be considered and more samples can be selected to make the prediction closer to the actual results.

REFERENCES

[1] China's Flood Prevention and Drought Relief: 1-14 [2024-01-28] Central People's Government of the People's Republic of China. Notice of the State Council on Issuing the National Emergency System Plan for the "14th Five-Year Plan" [N]. 2021-12-30.
[2] Summary of "China Flood and Drought Disaster Prevention Bulletin 2022" [J]. China Flood Prevention and Drought Relief, 2023, 33(10):78-82.
[3] Song Gangyong, Hu Honghao, Yang Maosong, etc. Practice and thinking on flood disaster prevention in Chongqing in 2023 [J/OL].
[4] Fu Zhiyan, Chen Jian. Research on disaster emergency material demand forecast model [J]. Logistics Technology, 2009, 32(10): 11-13.
[5] Zhao Xiaoning, Ma Changxi. Research on disaster earthquake emergency material demand forecast based on example reasoning [J]. Chinese Journal of Safety Science, 2012, 22(08): 3-9
[6] Liu Deyuan, Zhu Changfeng, Ding Wei. Research on emergency material demand forecasting method based on similar reasoning [J]. Journal of Lanzhou Jiaotong University, 2013, 32(04): 119-123.
[7] Wang Lanying, Guo Zixue, Zhang Yufen, Shang Yongsheng, Zhang Lu. Emergency material demand forecast model based on intuitive fuzzy reasoning [J]. Journal of China University of Mining and Technology, 2015, 44(04): 775-780.
[8] Chao Ying, Wang Qingrong. Emergency material demand forecast based on fuzzy rough set reasoning [J]. Transportation Science and Technology and Economics, 2015(5): 1-4.
[9] Liu Jianhua, Zhang Zheng, Wu Jieming. Urban flood disaster prediction model based on BP neural network [J]. Computer Engineering and Design, 2005(03):699-701+734
[10] Qian Fenglin, Cui Jian. Application of BP neural network model in emergency demand forecasting—taking earthquake casualty prediction as an example[J]. Chinese Journal of Safety Science, 2013, 23(4): 20-25.
[11] Guo Jinfen, Zhou Gang. Research on large earthquake emergency material demand forecasting methods [J]. Value Engineering, 2011, 30(22): 27-29.
[12] Xu Feng. Compound drought-high temperature changes in South China from 1961 to 2021 [J/OL]. China Flood Prevention and Drought Relief: 1-7 [2024-01-28]
[13] Liu Baoying. Tutorial on Uncertainty Theory[M]. Beijing: Tsinghua University Press, 2005: 1-2.
[14] Kaufmann A Introduction to the theory of fuzzy subsets[M]//Introduction to the theory of games. Физматгиз, 1977:1734-1734.
[15] ZadehL A. The concept of a linguistic variable and its application to approximate reasoning[J]. Information Sciences, 1975, 8(3):199-249.
[16] ZadehL A. Fuzzy sets[J]. Information & Control, 1965, 8(3):338-353.

[17] Wang Yi, Chen Xi, Pan Zitong, et al. Evaluation of county environmental carrying capacity based on coefficient of variation method [J]. Resources, Environment and Engineering, 2023, 37(06): 697-708.
[18] National Development and Reform Commission of the People's Republic of China. Notice of the General Office of the National Development and Reform Commission on the issuance of the classified catalog of key emergency supplies (2015) [EB/OL]. (2015-04-07)
[19] Zhang Xia, Wang Huichao, Li Yongdun, et al. Research on emergency resource dispatching considering demand under sudden flood disasters [J]. China Science and Technology of Production Safety, 2023, 19(12): 187-192.
[20] Luo Zhenmin, Pan Jingchao. Research status and development trends of emergency material demand forecasting [J]. Science, Technology and Engineering, 2023, 23(18): 7622-7630.